



# Overview of Product Safety Assessment of Consumer Products

**Presentation to DTSC**

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People trust our Brands to use every day in their homes to  
safeguard their family's health

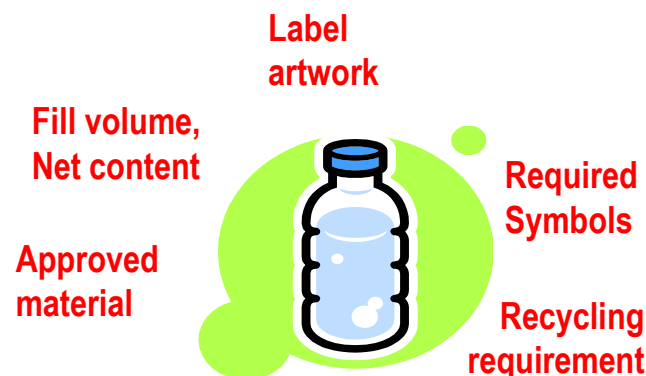
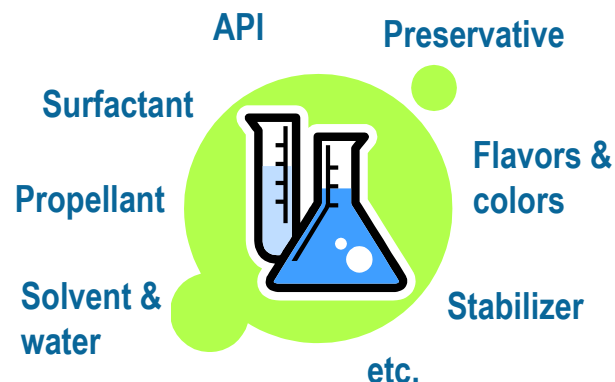
We take very seriously our responsibility  
to meet their needs safely

We follow rigorous safety & regulatory assessments to  
ensure that all products we place on the market are safe for  
use and compliant

# Regulatory & Safety Assessment

**Includes, but is not limited to, assessing:**

- **Ingredients**
- **Formulation**
- **Packaging**
- **Manufacturing**
- **Mandatory labelling requirements**
- **Product Classification**
- **Claims compliance with regulations**
- **Artwork approval**
- **Regulatory strategy to market**
- **Identification of Potential Issues to address, etc.**



# Social and Consumer Care



**In a unique position to understand the relationships between nutrition, hygiene and personal care**



**Seek to understand and manage our social, environmental and economic impacts, working in partnership**



**Safety is our No. 1 priority –**

**Safety & Environmental Assurance Centre (SEAC), Colworth, UK**

# SEAC's Role in Unilever



**Responsible for safety assessments of Ingredients and Products globally**

**Provide authoritative scientific evidence and guidance so that Unilever can identify and manage:**

- Risks for consumers, workers and environment
- Environmental impacts

**Safe, Sustainable Products & Processes by Design**

# SEAC's Wide-ranging Expertise

Deploying & developing capability in:

- Hazard characterization
- Exposure assessment
- Risk & impact assessment

for

## Consumer Safety

- Microbiology, Toxicology, Physical Hazards

## Occupational Safety (Safety at Work)

- Process Safety, Occupation Hygiene

## Environmental Safety

- Ecotoxicity

## Sustainability

- Eco-design, Life Cycle Assessment, Environmental Sustainability

**SEAC has subject matter experts in these fields**

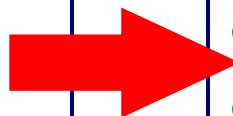


# A Risk-based Approach Facilitates Safe Innovation

We use **scientific evidence-based** risk assessment methodologies to ensure that the risk of adverse health and/or environmental effects from exposure to chemicals used in our products is acceptably low.

## Hazard-based

- Check-list compliance
- Unnecessary testing
- Doesn't consider how product is used
- Yes / no decisions
- Overly conservative



## Risk-based

- Expertise- & evidence-driven
- Essential testing only
- Product use / exposure determines outcome
- Options to manage risks
- Uncertainties explicit

# Outline



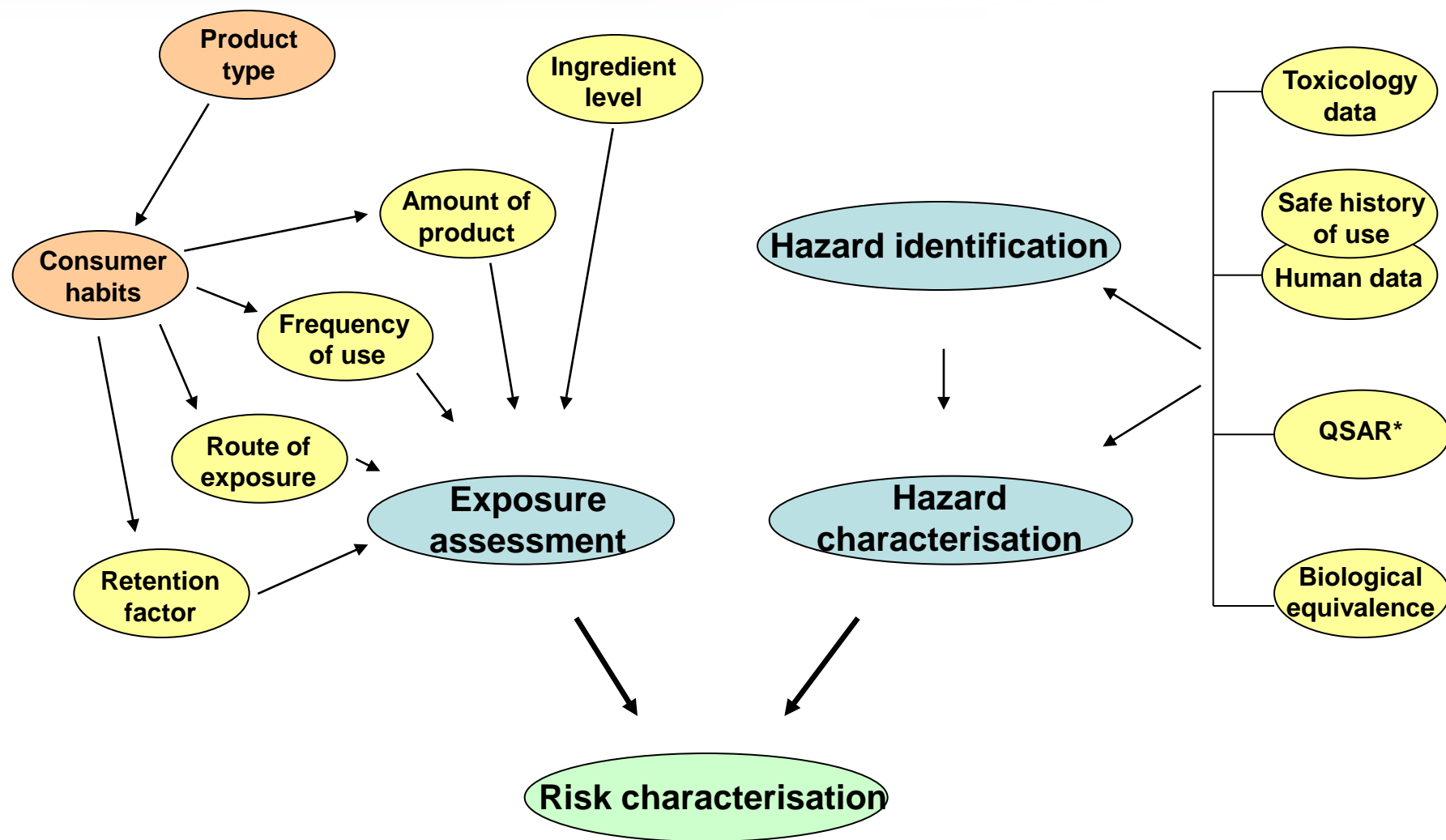
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  - Toxicology Risk Assessment
  - Microbiology Risk Assessment
- Environmental Safety
  - Environmental Risk Assessment
- Occupational Safety
- Sustainability
  - Environmental Impact Assessment



## When does Unilever conduct safety assessments of HPC products and ingredients

- Toxicological product safety assessments are conducted to support human consumer trials and marketing products where:
  - A novel ingredient is to be used in an existing product type
  - An existing ingredient is used in a new product type/format
  - Levels of ingredients are modified in an existing formulation
- Safety assessment may also be conducted in the case of product incidents (e.g. contamination, manufacturing error)

# Risk based approach for evaluating consumer safety of ingredients and products



\* Quantitative Structure-Activity Relationship

# Toxicological hazard endpoints considered

**As with all toxicological safety assessments, relevant hazard endpoints are considered, dependent on the potential route of exposure:**

- **Acute toxicity**
- **Irritation (skin and eye)**
- **Skin sensitization (type IV allergy)**
- **Allergy (type I)**
- **Phototoxicity**
- **Systemic toxicity**
- **Reproductive toxicology including teratogenicity**
- **Genotoxicity**
- **Carcinogenicity**
- **Inhalation toxicity**

# Identifying and Characterising Toxicological Hazards



- **For the majority of ingredients, toxicological data already exist**
- **For some ingredients toxicological evaluations will also have been conducted by external experts; e.g. EU SCCS, CIR, PCPC, RIFM, FEMA, GRAS, ECHA (REACH)**
- **Wherever possible, existing data are used in safety assessments for ingredients**
- **In all cases, published/manufacture data, and published toxicological evaluations are scrutinised and their robustness established**

# Identifying and Characterising Toxicological Hazards



- **QSAR evaluation, including read across to similar chemicals, may be used for an initial evaluation**
- **Other considerations such as safe history of use or human clinical data can be used in a weight of evidence approach**
- **Where data do not exist, or are not considered to be fit for purpose, toxicological testing may be conducted to identify and characterise the toxicological hazard**
- **Unilever does not test its products on animals for the purposes of assessing consumer safety, unless required by law**
- **Alternatives to animal testing are employed when possible**

# Safety Evaluations of Products



- Initial step is to evaluate ingredients in each specific product type
  - Relevant toxicological endpoints are considered
- In many cases consumer safety of the product is evaluated based on its similarity to other marketed products (Safe History of Use)
- In some cases evaluation of the irritation potential of the product will be benchmarked by conducting:
  - In vitro tests; e.g., Rabbit enucleated eye, Episkin
  - Human studies; e.g., covered patch test, arm immersion studies
- Individual ingredients are evaluated for relevant toxicological endpoints based on consumer exposure

# Risk assessment based on Understanding Consumer Exposure



- Establishing the extent to which consumers are exposed when using a product is fundamental to the risk assessment
- Risk to consumers is dependent on:
  - Route of exposure
  - Amount of exposure

- Mode of use has a big impact on how much product the consumer is exposed to. For example:
  - Use of most personal care leads to direct exposure
  - Standard use of toilet cleaner leads to minimal exposure





# Estimating Amount of Consumer Use of Products

- **Informed estimate of typical use (e.g., a consumer will use 10mL shampoo once a day)**
  - May be based on personal habits
  - May be based on pack instructions
  - Often worst case
- **Often obtained from marketing company**
  - Best estimate of how much product is used
  - Marketing data
  - Consumer trial data
  - Consumer habits surveys
- **Published surveys**
  - COLIPA Study (Europe)
  - PCPC Studies (US)
- **Internal databases**

# Other Exposure Factors-

## Dermal Exposure

- Retention

- Where a product is left on the skin (e.g., skin cream), potentially all is available to be absorbed to give a systemic exposure
- Many products are in brief contact with the skin before being rinsed off (e.g., shower gel)
- It is assumed that in most rinse-off situations 1% of the product remains on the skin after rinsing
- Standard practice is to include a retention factor of 0.01 when conducting an exposure calculation to account for this

- Skin penetration

- For risk assessment of systemic toxicity endpoints an evaluation is required of the amount of ingredient penetrating the skin
- In most cases 100% skin penetration is assumed in an initial risk assessment. If acceptable (i.e., sufficient safety margin) then further quantification of skin penetration may not be required
- In some cases, experimental estimation of skin penetration of ingredient from the formulation is required – this is generally conducted using an ex vivo skin model (pig or human skin)

# Measuring Inhalation Exposure



- Where inhalation of a product may occur, studies can be conducted to measure this
- Usually concerned with aerosol or pump spray products. Other products can be tested under simulated use conditions
- Can measure inhalation of volatile and non-volatile components
- Can also measure secondary exposure

**Respirable Dose** (RDose) is an estimation of the weight of non-volatile respirable material ( $<7\mu\text{m}$ ) that has the potential to be deposited in the bronchial, bronchiolar and alveolar regions of the human lung if inhaled under simulated use conditions.



# Estimating Ingestion of Products

- Some products will potentially be ingested during normal use
- These include toothpaste, mouthwash and lipstick/lip balm
- Also includes dishwash products which may remain on crockery/pans after washing
- In these cases an estimation of the amount ingested in use is made; e.g., a child may ingest 0.5g toothpaste whilst brushing their teeth
- Amount swallowed is taken to represent systemic exposure in the risk assessment (i.e., gut penetration = 100%)



# Conclusion: Safety Assessments of Ingredients & Products

- The risk assessment requirement is driven by the amount and route of exposure, which in turn is driven by the product type
- For each ingredient/product, the critical endpoint needs to be determined that is relevant to both the exposure conditions and the relevant toxicology hazard data
- Where standard toxicology data are available, a standard risk assessment approach is taken:
  - Margin of safety for systemic toxicity effects
  - Quantitative Risk Assessment for sensitisation
- In some cases the safety assessment will be based on a weight of evidence approach; e.g., using history of use, QSAR approaches
- Where exposure is very low (e.g., little consumer contact with product, insignificant skin penetration) it may be possible to use exposure based waiving based on the concept of the threshold of toxicological concern, (TTC)

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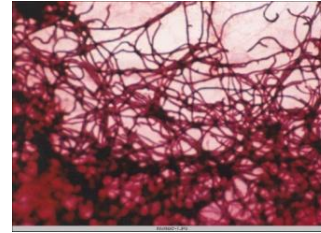


# Microbiological Risk Assessment – HPC products

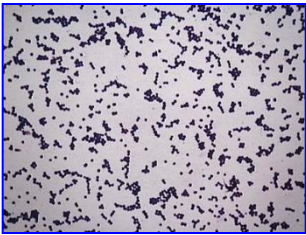
- Microorganisms in HPC products can cause both spoilage and safety risks



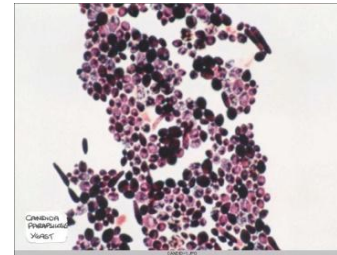
**Gram negative bacteria**  
e.g. Burkholderia,  
Pseudomonas, Klebsiella,  
Enterobacter



**Moulds e.g.**  
**Aspergillus**



**Gram positive**  
**bacteria e.g.**  
**Staphylococcus,**  
**Bacillus**



**Yeasts e.g. Candida**

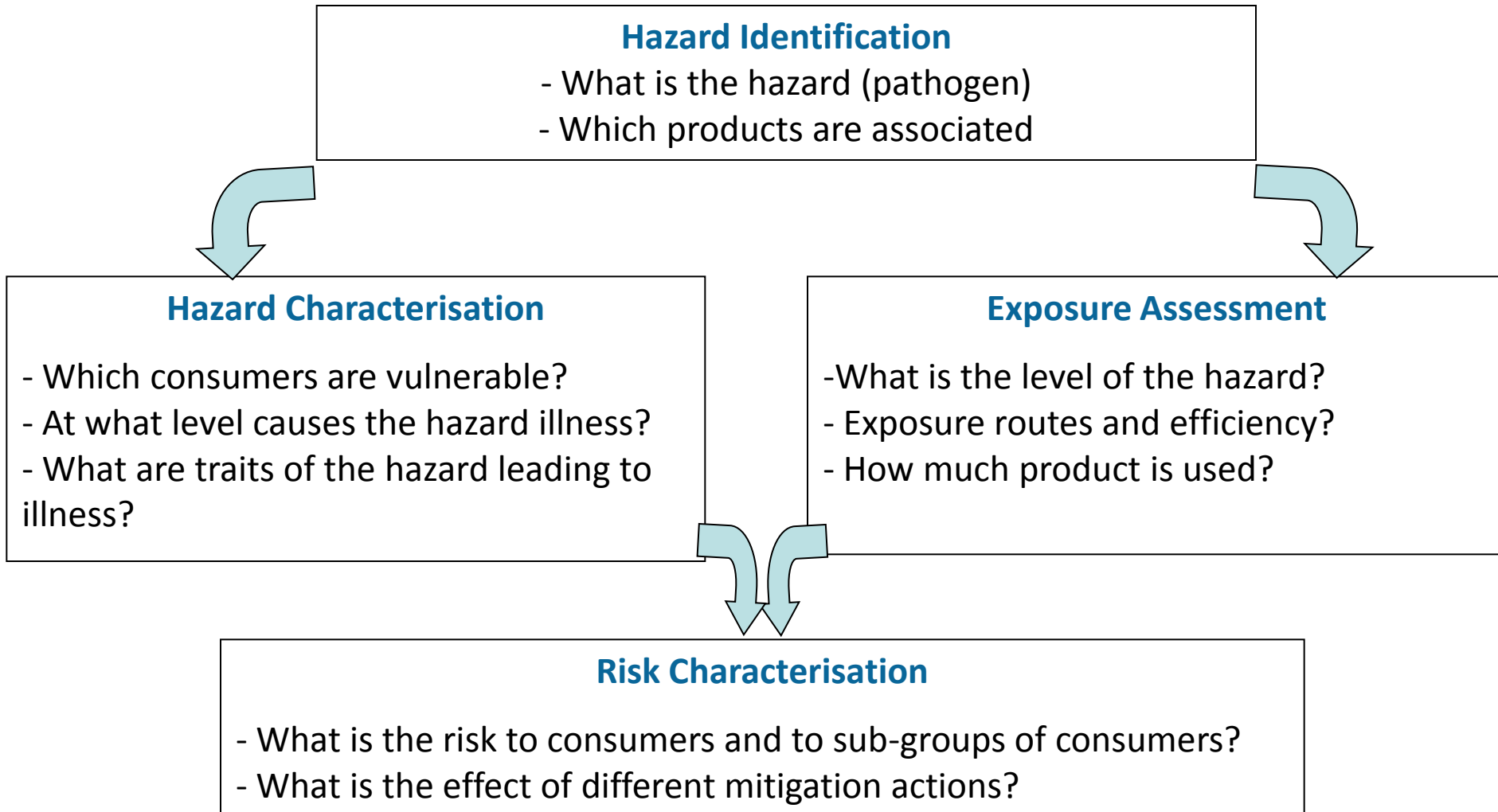


# Hygiene Risk Assessment



- Does the formulation require a preservative?
- Consider the degree of self preservation of product:
  - pH
  - Water Activity
  - Negative Ingredients (help the organisms survive)
  - Positive Ingredients (help to kill/ control the organisms)
- Consider the packaging
  - Consumer contact and in use risks
  - Material e.g. paper / card
- Challenge testing is carried out on HPC liquids considered to have a hygiene risk.
  - Preserved & unpreserved formulations are tested against bacteria, yeast and mould

# Safety Risk Assessment: Steps



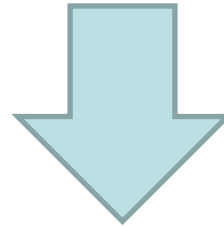
# Microbiological Risk Assessment – outcomes

## Hygiene Risk Assessment

Assess hygiene risks in HPC innovation formulations to ensure that the formulations are adequately preserved to meet the demands of their life span

## Safety Risk Assessment

Using a Microbiological Risk Assessment framework to assess  
- Hazard ID, Hazard Characterisation, Exposure Assessment and Risk Characterisation



## Safe and Stable by Design

- Organisms controlled to acceptable limits for spoilage and safety
- Often relies on preservatives
- **Preservative replacement or reduction can impact growth of microorganisms and therefore safety and stability of HPC products**

# Outline



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# Why are ecotoxicology and risk assessment important?

- Unilever uses high volumes of surfactants (EU figures):

400 000 tpa of LAS\* (3g/person/day)

290 000 tpa AE\* (2g/person/day)

700 000 tpa fatty acids (5g/person/day)

30 000 tpa CAPB\* (0.27g/person/day)



Use of mass market products results in continuous & widespread discharge into the environment, mostly via “down the drain” disposal

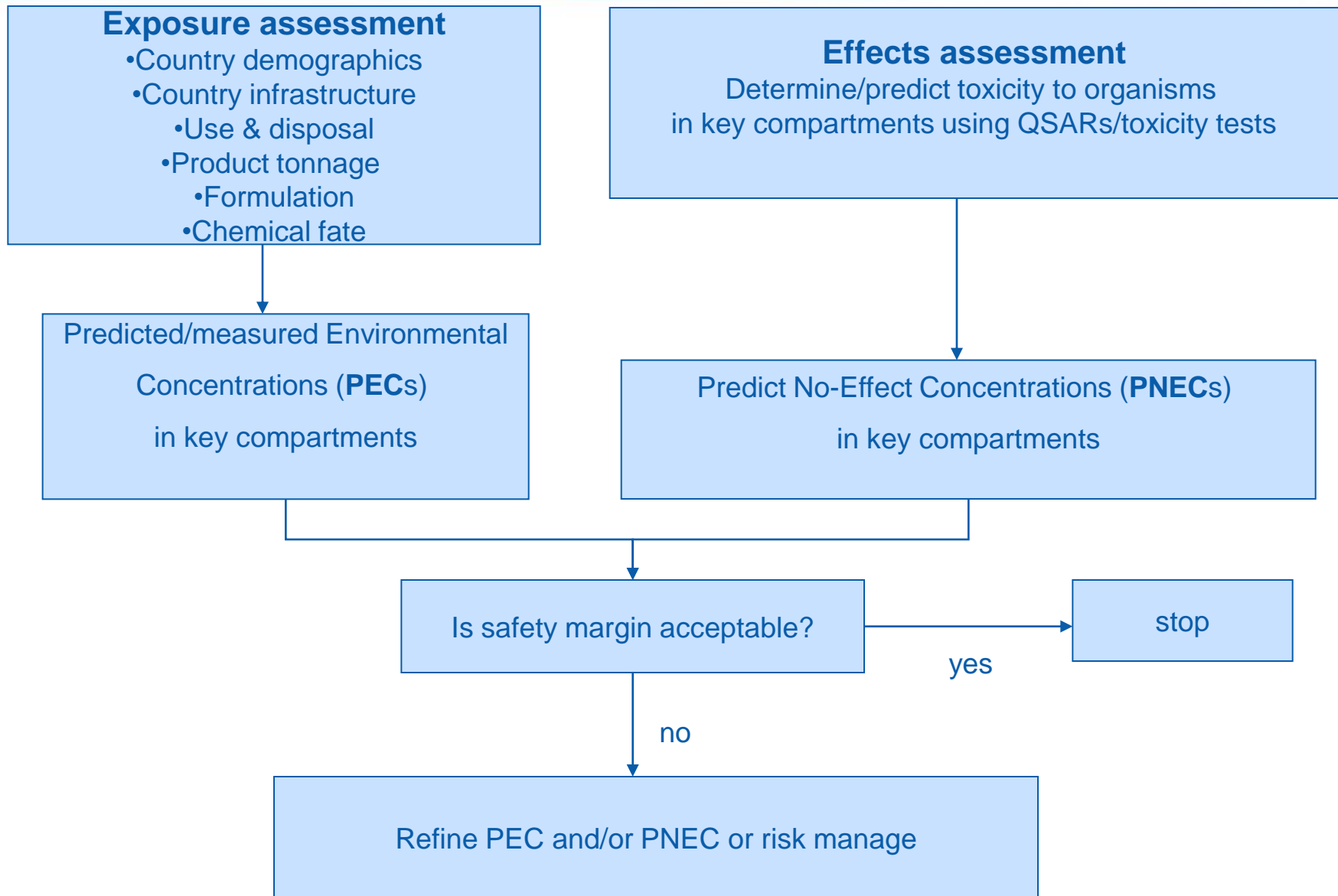
\* Linear Alkylbenzene Sulphonates  
Alcohol Ethoxylates  
Cocamidopropylbetaine

# Chemicals in consumer products *can be hazardous*

Chemical	Function	Environmental Half life	Acute aquatic toxicity (mg/L)
A	surfactant	days	5
B	surfactant	hours-days	1
C	surfactant	weeks-months	0.3
D	Hair conditioner	months-years	0.01
E	antidandruff	days-months	0.003
F	preservative	days	0.001
G	antioxidant	days-months	5
H	UV sunscreen	weeks-months	2
I	Moisturiser/ lubricant	months-years	Non-toxic

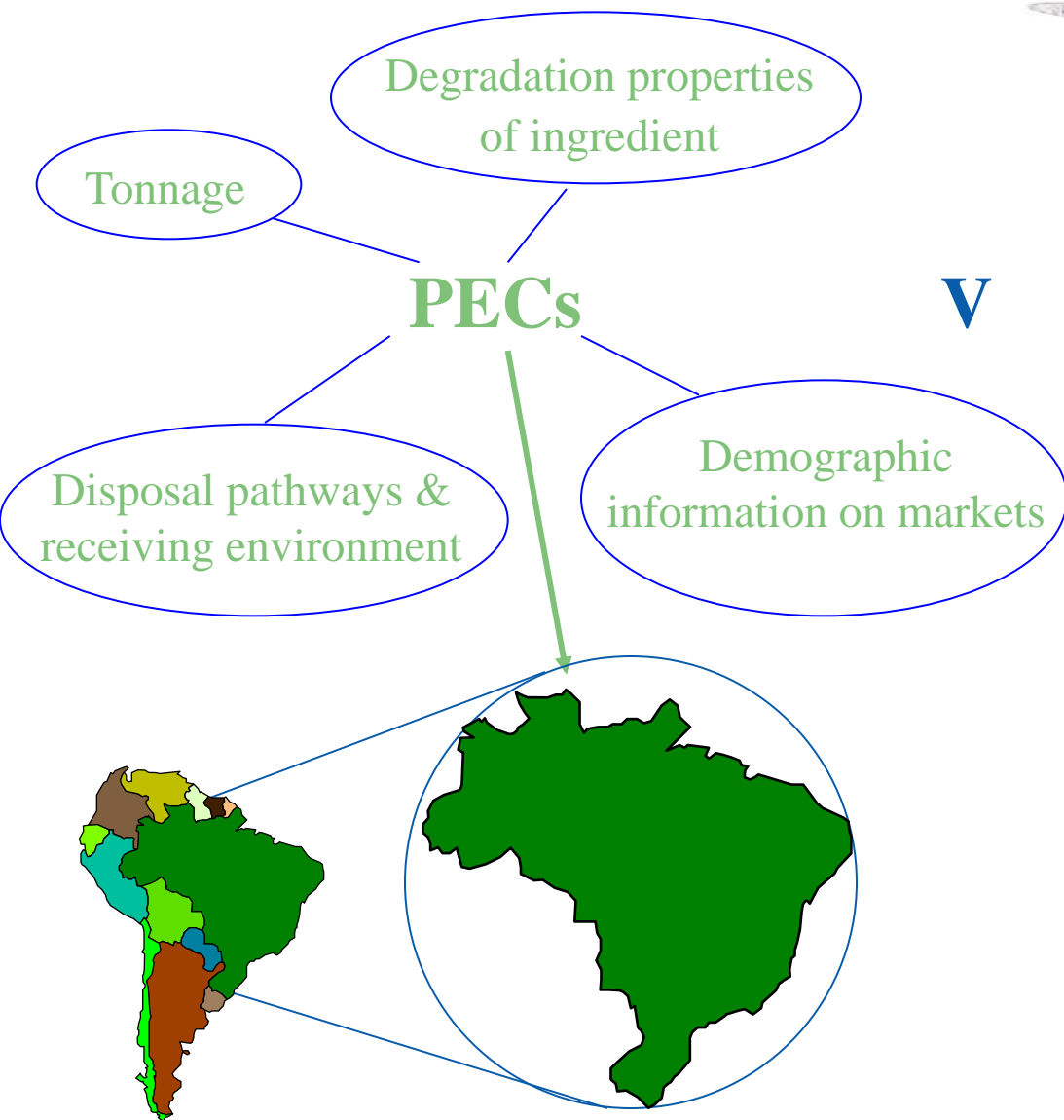
All of the above ingredients are include in products to give a definate benefit

# Environmental Risk Assessment





# Information required



nematodes



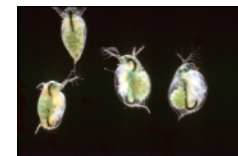
earthworms

Sediment toxicity

Soil toxicity

PNECs

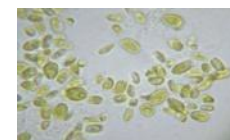
Aquatic toxicity



Daphnia



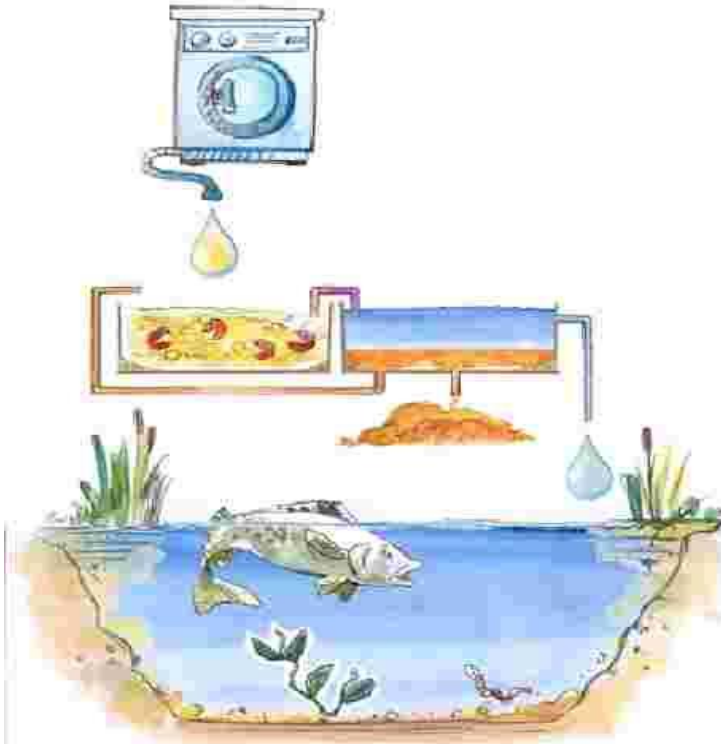
Fish  
(if essential)



Unicellular algae

# PEC estimation

## Sewage Treatment



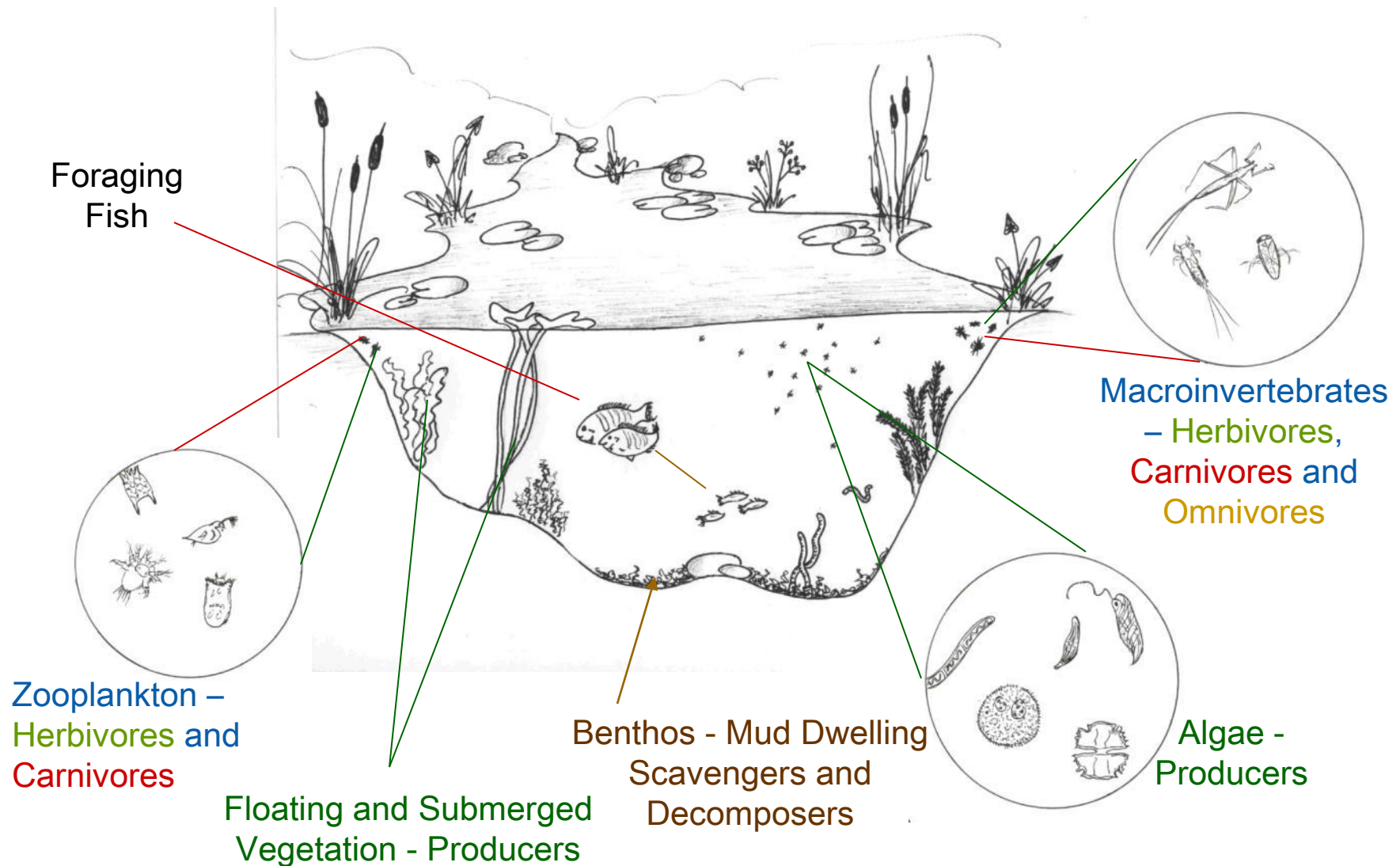
## Terrestrial Risk Assessment



## Aquatic & Sediment Risk Assessment



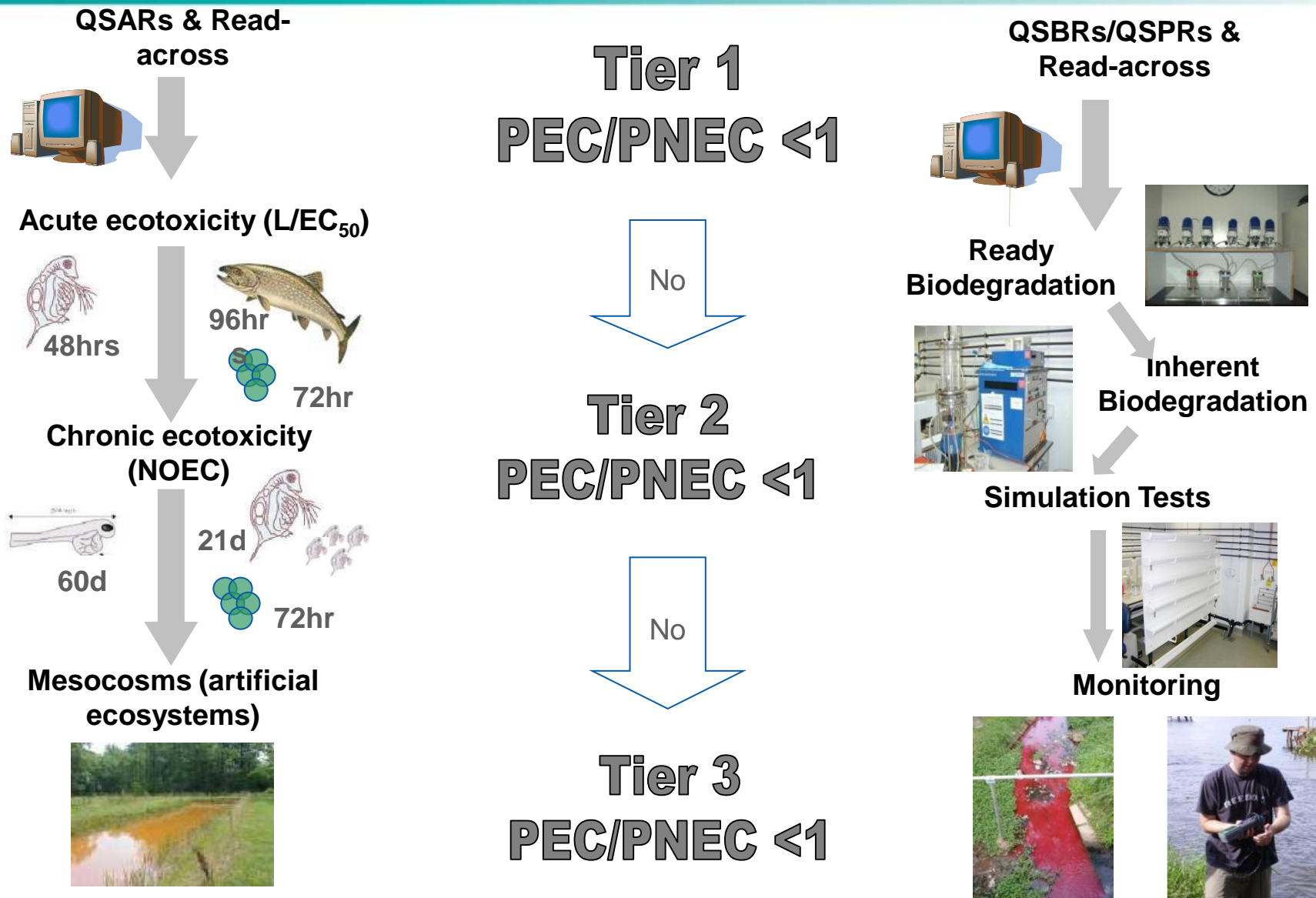
# Aquatic Communities - how can we assess the most sensitive spp?



# Derivation of PNECs - Effects assessment

- **There are 2 approaches for estimating a PNEC:**
- *Use of application factors - deterministic approach:*
  - 3 acute (algae, Daphnia, fish) - Lowest EC50 1000
  - 3 chronic (algae, Daphnia, fish) - Lowest NOEC 10
- *Use of statistical extrapolation - SSD*
- If at least 10 NOECs on different spp (8 taxonomic groups) are available it may be appropriate to use a statistical extrapolation approach.

# Tiered Approach to ERA





# Conclusions



- **We need to ensure our products have adequate environmental safety profiles while performing their function to the high standards dictated by consumers**
- **Use of consumer products results in large tonnages of many chemicals that are disposed to waste systems**
  - high potential for environmental exposure - need to assess environmental safety.
- **Wide range of aquatic toxicity tests available**
  - Ecological relevance needs careful attention
- **Environmental risk assessment**
  - most appropriate method for assessing acceptability
- **Risk assessment methodology is simplistic in comparison to the complexity of the environment**
  - need many advances in understanding
  - Higher tier refinement is best done in consultation with regulators

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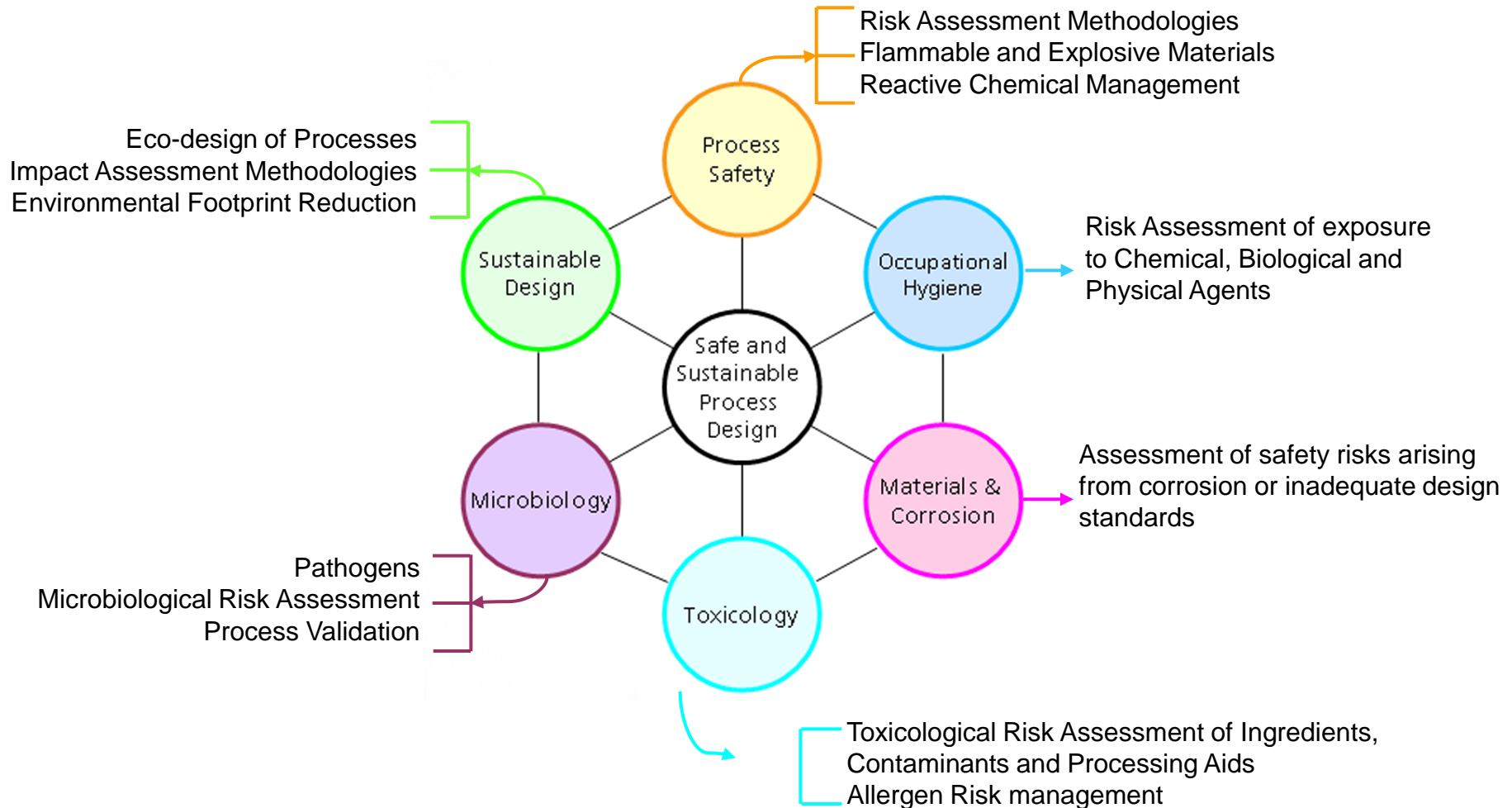


# What do we mean by Occupational Safety



- Managing Hazards and Risks that arise across the Source - Make - Deliver continuum for protection of Employees, Members of the Public and Plant.  
Considering:
  - **Ingredients**
  - Formulation
  - Process Conditions
  - Equipment / Technologies
  - Packaging
  - Local Factors (e.g. scale, climate, resource / manning) etc.

# SEAC Safety and Sustainability Capability



# SEAC Occupational Safety Areas

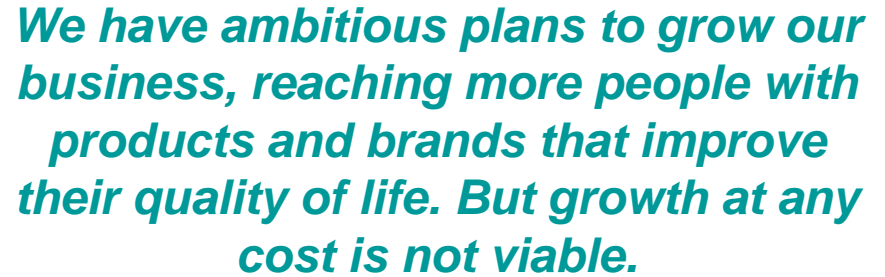
- **Specialist Technical Areas**

- Fire and Explosion Hazards
  - Flammable Gases / Liquids
  - Combustible Dusts
- Chemical Reaction Hazards
  - Thermal Stability
  - Self Heating
- Transport of Dangerous Goods
- Occupational Hygiene
  - Exposure to Hazardous Chemicals
  - Handling of Toxics and very Toxics
  - Respiratory and Skin Sensitisers
  - Allergens (e.g. enzymes)
- Noise Management
- Materials of Construction and Equipment Reliability

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Small Actions. Big Difference.

Small Actions. Big Difference.



Launched November 15th 2010

- **Broad:** life cycle approach, decouple economic growth from our environmental impact
- **Deep:** 50 time bound public goals
- **Scale:** across the whole business
- **Triple bottom line**
- **Scientific rigour**
- **Track record**
- **We want to work with partners**

# Unilever Product Metrics



## 1. Greenhouse gases per consumer use

CO<sub>2</sub> equivalents across the product lifecycle (grams)



## 2. Water per consumer use in water-scarce countries

Water added to the product plus the water used by consumers in water-scarce countries (litres)



## 3. Waste per consumer use

Packaging and product leftovers that have not been re-used, recycled or recovered (grams).



## 4. Sustainable sourcing per weight of material

Raw or packaging material being sourced from verifiable sustainable renewable sources or made from recycled materials (% by weight)

## Why four environmental metrics?

- Representative of the key environmental impacts of our product portfolio
- Stakeholder views
- Measurable
- Inform management decisions



# UNILEVER'S GREENHOUSE GAS FOOTPRINT

## FULL VALUE CHAIN





# Summary



- Safety assessments are often bespoke – there is no “one size fits all” approach
- Safety of ingredients, products and processes is designed in from the start of the innovation process
- Substitution of an ingredient, or inclusion of a new ingredient in a consumer product needs to be considered at many levels
  - A risk-based approaches to all aspects of consumer, occupational and environmental safety are used
  - The environmental impact across the value chain needs to be considered
    - A variety of metrics are necessary to ensure that an improvement in one metric is not at the expense of another
  - The function of the ingredient in the product e.g. preservative
- To fully assess the risks and impact of a new ingredient or product it is necessary to cover a wide breadth of scientific domains

# References



- [http://ec.europa.eu/health/scientific\\_committees/consumer\\_safety/index\\_en.htm](http://ec.europa.eu/health/scientific_committees/consumer_safety/index_en.htm)
- <http://www.cir-safety.org/>
- <http://www.ctfa.org/>
- <http://www.rifm.org/>
- <http://www.femaflavor.org/>
- <http://www.fda.gov/Food/FoodIngredientsPackaging/GenerallyRecognizedasSafeGRAS/default.htm>
- <http://apps.echa.europa.eu/registered/registered-sub.aspx#search>